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Crystal growth patterns in undercooled Co67Sn33 hypereutectic alloy containing minor Nb

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ABSTRACT

The growth of non-planar interfaces during solidification can be classified into two major modes: dendritic and seaweed. During dendritic growth, the new branches form at a distance behind the tips of the existing branches. In contrast, seaweed growth occurs when the new branches form by branching at the tip of the existing branches, with their subsequent growth directions varying constantly. Currently, our knowledge of seaweed crystal growth in metals is very limited. In the present work, the growth behavior of primary β-Co3Sn2 phase in (Co67Sn33)100-*x*Nb*x* (*x* = 0, 0.5, 0.8, and 1.0) hypereutectic alloys at different melt undercooling was investigated. The growth pattern of β-Co3Sn2 phase at low undercooling changes in the Nb content from fractal seaweed (*x* = 0, 0.5) into dendrite (*x* = 0.8) and then returns to fractal seaweed (*x* = 1.0). As undercooling increases, the dendritic growth of β-Co3Sn2 phase in (Co67Sn33)99.2Nb0.8 alloy gives way to fractal seaweed growth at an undercooling of 32 K, and compact seaweed growth above a larger critical undercooling, as occurs in the other three alloys investigated, accompanied with a sharp rise in growth velocity. The growth velocity of β-Co3Sn2 slightly increases at low and intermediate undercooling but decreases at larger undercooling due to Nb addition.

KEYWORDS: crystal growth pattern, undercooling, third element, interfacial energy anisotropy